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U. S. DEPARTMENT OF AGRICULTURE.

OFFICE OF ROAD INQUIRY.

BULLETIN No. 5.

INFORMATION

REGARDING

ROAD MATERIALS AND TRANSPORTATION RATES

IN CERTAIN STATES WEST OF THE MISSISSIPPI RIVER.

(FURNISHED BY OFFICIALS OF VARIOUS RAILWAY COMPANIES.)

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF ROAD INQUIRY,
Washington, D. C., April 2, 1894.

SIR: The accompanying reports and letters have been received in response to a circular of inquiry sent out by this office under date of October 16, 1893, asking railway managers for information in regard to the supply of good road materials, accessibility, transportation rates, etc., along the lines of their respective roads. They contain suggestions and data which will be of great value for distribution in the district west of the Mississippi River, and their publication is respectfully recommended.

Very respectfully,

ROY STONE,
Special Agent and Engineer in Charge.

HON. J. STERLING MORTON,
Secretary.

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ROAD MATERIALS AND TRANSPORTATION RATES IN CERTAIN STATES WEST OF THE MISSISSIPPI RIVER.

UNION PACIFIC RAILWAY COMPANY.

[Report furnished by Mr. E. Dickson, of the construction department, Omaha, Nebr.]

NEBRASKA.

The supply of good materials for road-making, that is, materials of sufficient value to justify the expense of preparing, loading, and transporting, is limited. Such materials consist of stone, gravel, and gumbo, a soil which, when thoroughly burned, forms an excellent material for making a good roadway.

Stone is found only at points on the Omaha and Republican Valley Railway line south of Beatrice. It is a soft limestone, easily crushed, and adjacent to track and right of way. Cost of crushing to convenient size for use in road work, including loading on cars, would range from 40 to 80 cents per cubic yard.

There is also stone along the main line between Sidney and Cheyenne, Wyo., but this is too far from the portions of the State where it could be used to be of value for road-making.

Gravel is found in limited quantities at or near the following places: Papillion, Wahoo, Silver Creek, Kearney, Big Springs, and Sidney. It is rather fine in quality, being about one-third sand. It is so situated at each place as to be reached with side tracks. Estimated cost, loaded on cars, including purchase of land, stripping, and trackage, is from 15 to 30 cents per cubic yard.

Gumbo, or clay soil suitable for burning into ballast, is found in bottom lands adjoining small streams in the eastern part of the State and on lines north of Columbus; is easily accessible from line of railway; estimated cost of preparation, 50 to 75 cents per cubic yard; estimated cost of loading on cars, 10 to 15 cents per cubic yard.

In general, the soil over the greater part of the State reached by Union Pacific lines is very favorable for making good roadways, being

of such a sand and gravel nature as, when graded up so as to drain properly, forms a roadway which is seldom very muddy and never impassable. It dries out quickly after rains or in the spring when frost leaves the ground and hardens so as seldom to be objectionably dusty. It is also easily and at small expense maintained in good serviceable condition.

This natural soil, while good for use as described, is not of sufficient value to warrant the expense of loading and shipping it to such parts of the State as are not naturally so favored. Those portions of the State to which materials for road-making would require to be transported are situated between Omaha, Stromsburg, and Beatrice, and adjoining lines north and west from Columbus, especially across bottom lands adjoining small streams and in the streets of cities and villages.

KANSAS.

The only good road material found along the lines of the Kansas division is limestone, which is abundant in the eastern counties of the State of Kansas, through which our lines run, and is accessible at various points on our lines, from the east line of the State of Kansas west 150 miles in the counties of Wyandotte, Leavenworth, Jefferson, Shawnee, Jackson, Pottawatomie, Riley, Geary, Clay, and Dickinson.

This stone, crushed to convenient size for macadamizing, costs, delivered on cars, from 60 cents to \$1 per cubic yard. There are limited quantities of stone in most of the other counties in Kansas reached by our lines, but most of it is too soft for good road material. Stone is the only material fit or used for road-making except the soil.

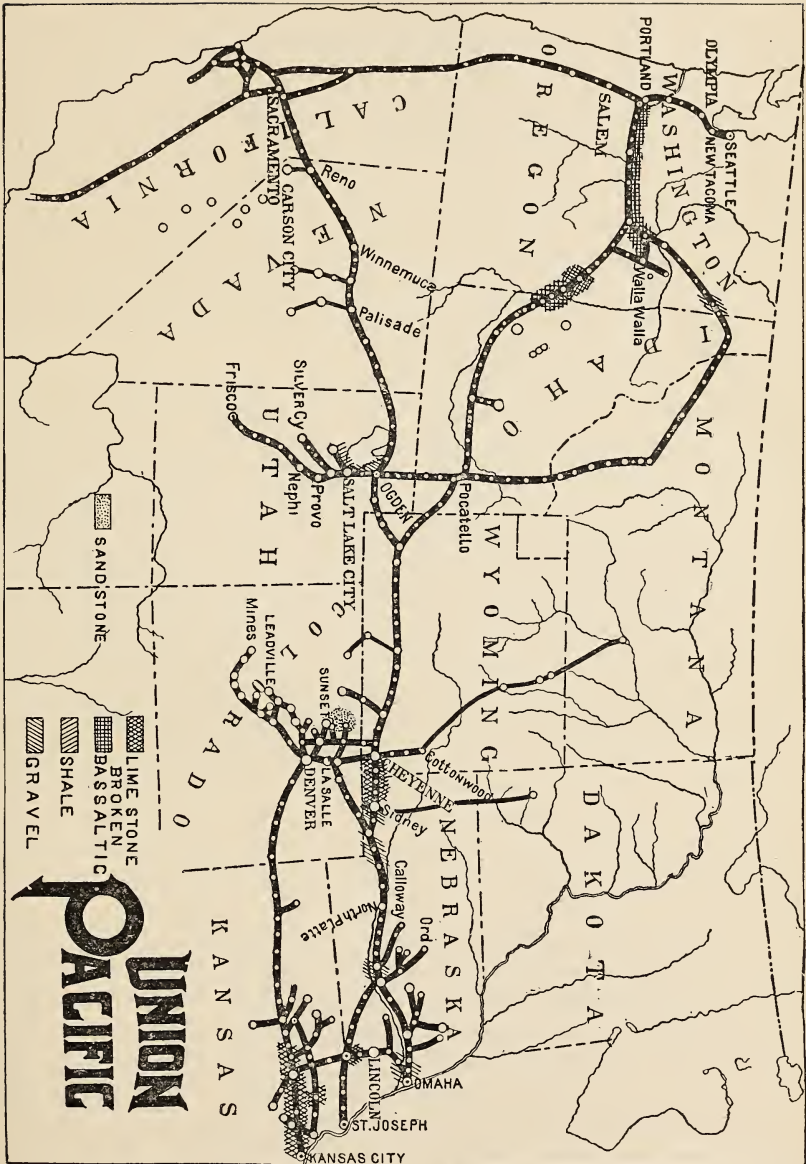
COLORADO, WYOMING, AND NEW MEXICO.

The natural characteristics of Colorado, Wyoming, and New Mexico are very similar, and anything said of one with reference to materials and methods for improving highways would be equally true of the others, with but few unimportant alterations. The following remarks refer particularly to Colorado, but, except in a few minor details, will apply as well to Wyoming and New Mexico.

Generally, very little is being done towards the permanent betterment of public highways throughout Colorado, the repairs and maintenance in most cases being of temporary nature.

All public highways are either in the hands of the county, or "toll roads" in the hands of private corporations. The State has at various times built roads in the mountain districts, but all such are upon completion turned over to the county or counties through which they pass.

The public roads on the plains east of the mountains, and those in the mountain regions, being so different in character, it may be well to consider them separately.



These roads usually follow the Government section lines, and under the present State laws are to be 60 feet in width. No limit as to gradient is fixed by law. All these roads, so far as known, are under the jurisdiction of the county commissioners of the respective counties, who appoint road overseers to look after all maintenance and repairs. New roads are located and opened by "viewers" appointed by county commissioners, upon petition by interested freeholders along or adjacent to proposed road, who view the proposed route, locate the proposed road, and report the result of their labors to the county commissioners. Viewers have the power to call on county surveyor or other competent surveyor for a survey of proposed road; but this, when done, is usually more for the purpose of defining the route selected by the viewers and mapping the same than for the purpose of selecting the best route or locating the best line for proposed road.

There is nothing in the statutes to prevent locating roads at other than along Government section lines, but this plan is usually followed where topography of the country permits, especially in the agricultural and stock-raising districts, it having the advantage of leaving farms and ranches more intact and allowing a larger number of property-holders to have frontage upon the road. The formation, topography, climate, and soil of this portion of the State are excellent for good roads, and it is probable that better roads are maintained with less work here than in almost any other portion of the United States. Generally, the soil is a sandy loam that packs very hard under traffic; it never becomes sticky, even when kept constantly wet. The hardness of the roads prevents softening to any considerable depth by short rains. The topography usually is such as to give good natural drainage. Rains are not frequent, and the soil dries rapidly and does not rut or become quaggy, yet it cuts badly and rapidly under a swift current of water, thus requiring some attention as to drainage where a considerable amount of water is liable to accumulate and wash over or along the road.

On account of the natural favorable conditions, as above stated, the repairs on these roads consist principally of preventing water from flowing along the roads and thus washing them out, and repairs to occasional points where creeks or arroya beds render repairs or grading up necessary. Grading is sometimes required at these points to raise the road above the natural surface, which is liable to overflow, while in other cases the soil may be so sandy as to render the road "heavy" for traffic.

Occasionally short stretches of clayey or loamy soil are found, but these cases are rare. The repairs made on these roads are, in almost every case, made with the sandy loam of which the larger portion of the surface of this part of the State consists; and materials are rarely hauled more than a few hundred yards to repair a road or raise a grade, and it

is doubtful if, for many years to come, there will be any call for road material other than what can be found close at hand.

The value of Colorado natural roads is in many cases much impaired by steep grades into and out of arroyas and creek bottoms. These, however, are in some cases being reduced and bettered.

It is claimed that the present system of making repairs and maintaining roads in this State is a great improvement over the system where road taxes are worked out by land-owners along the road; and this is doubtless true, as the work is more ably directed and done at points where it is most needed.

At any point along the eastern base of the mountains excellent stone for road material is found; at several points crushers are being run, and broken stone suitable for macadam is being shipped by rail. This stone, however, in no case has been applied to roads other than in the form of concrete base for pavements in Denver (which is the only city or town in Colorado, Wyoming, or New Mexico which has found it necessary to pave its streets). At points too far east of the mountains for this stone to be available there is usually plenty of good gravel in the beds of streams and elsewhere, which makes an excellent top-dressing for streets or roads. This gravel is sometimes used on streets, but rarely on roads outside of towns or cities.

Quarries at Stout and Arkins are delivering crushed stone in Denver at \$1.20 per ton f. o. b., or 60 cents per ton on board cars at quarry. A crusher is also in operation at Lyons, Colo., on the Burlington Railroad. There are several granite quarries on our lines, but thus far no crushers have been set up at any of them.

The stone at quarries mentioned, where crushers are located, is in all cases a vitrified, stratified sandstone, and is extensively used for heavy foundations, paving blocks, etc.

Mountain roads.

In the mountain districts a very different state of affairs exists from that found on the plains. Here the roads follow canyons, gulches, or any other practicable route, regardless of Government or other land lines, while many of the most important roads are "toll roads" owned by toll companies incorporated under the State laws. In the past these roads have been of various widths. These widths, however, were in practice usually very limited, as a road wide enough for one vehicle, with occasional "turnouts" for passing, was and is still considered wide enough.

Mountain roads belonging to the public are located and opened in the same manner as roads in other parts of the State, are subject to the same laws and the same manner of supervision, and are repaired and maintained under the same system as the public roads on the plains.

There is very little agricultural land along our mountain roads, and most of the traffic originates from the timber or mining resources.

The formation, topography, climate, and soil are usually not such as to favor good roads, and the traffic over them is in many cases very destructive to a road, yet not sufficient in bulk to warrant the heavy expense that would be necessary to build and maintain a first-class road. Many of the counties in which these roads are located and by which they are maintained have a small population, a small assessment, and a large mileage of these roads to maintain. Their road fund is small compared with amount and class of roads to be maintained; consequently they are not in all cases kept in good condition for traffic.

Many of these roads are located with a view to economy in construction rather than economy in haul over them. Roads that when located were expected to have light traffic have frequently been subjected to a much heavier traffic than was evidently expected; yet a change to provide a road suitable for this increased traffic is often delayed on account of the expense that would be necessary to make such changes.

Generally the material available for improving mountain roads is first class and near at hand; but the light travel on many of these roads, the small number of (and quite scattered) settlements, and the small road funds render the use of this material rare and the repairs usually of a very temporary nature.

Heavy traffic on mountain roads is usually in the mining or lumber districts. These roads are usually bad, except in the summer months. The ore haul is usually so arranged as to be a downhill haul, and in such cases heavy loads are hauled and narrow-tired wheels are mostly used. The effect of a 4 or 5 ton load on narrow tires, hauled over a steep road seldom repaired, softened by rain or melting snow, is usually such (except during the dry summer months) as to render it almost impassable for uphill traffic, especially at points where these roads cross streams or marshy creek bottoms.

There is great need of improvement in the mountain roads near some of the mining camps, in location and grades as well as in repairs and maintenance.

Toll roads are usually fairly maintained and kept in fair condition for the traffic passing over them. The tolls are in some cases heavy, but probably seldom in excess of what is necessary to bring in an income sufficient for the expenses of the toll-road company. It is doubtful if the amount now paid for the maintenance of roads in the mountain districts could be so applied as to do much toward permanently improving the roads, as any material changes in these roads would be, in most cases, quite expensive. The road fund in most cases is applied only to keeping the roads open for traffic, and as cheaply as possible. There is not at present sufficient population in the mountain districts to warrant steps being taken to materially change or better the roads, especially where these changes would involve much expense in thinly settled districts.

UTAH.

Plenty of gravel of good quality can be obtained around the entire rim of the Great Salt Lake basin. There is no trouble to find good pits accessible for all wagon-road purposes. Gravel has been and is still extensively used in the streets of Salt Lake, Logan, Ogden, and other important Utah towns. Generally, for all practicable purposes, gravel could be obtained in the easterly and northerly parts of the Salt Lake basin without resorting to railway transportation. We have some excellent gravel banks opened on our Utah division, and at towns mentioned above pits have been opened and in use for years.

Along the shore of the Great Salt Lake shale beds are found. This material makes an excellent road, but can only be used to a limited extent.

In general, if wagon roads in Utah were constructed with a view to good drainage, little or no trouble would be imposed in maintaining them. The small amount of rain in spring and fall is all that would have to be provided against. The absence of rain to a great extent insures good roads during the greater part of the year.

IDAHO.

Very little gravel is accessible in Idaho for road-making. In general, the roads in the lava country of Idaho need no material at all and are in fair condition. Along streams there are points that should be improved, and at such places rock and brush are plentiful for repairs and permanent work. With reasonable drainage good roads can be made the rule throughout Idaho. A small outlay in engineering is about all that is necessary to secure good roads in this country.

The State of Idaho, at the last session of the legislature, appropriated quite a large sum to construct a north and south road.

OREGON AND WASHINGTON.

Very little has been done in improvement of roads in Oregon and Washington up to the present time. With one or two exceptions, the public highways are all county roads. Where the topography of the country will admit of it, these county roads are located on section lines, but in most cases the country is so badly broken up that it is impracticable to follow section lines and the roads follow valleys, streams, gulches, or other practicable routes, where reasonably good grades can be obtained regardless of land lines.

The maintenance of these county roads is looked after by road supervisors, appointed by the county courts, who act under the general directions of the courts. The repairs and improvements made by these road supervisors are very limited and temporary, as about the only means they have of doing the work is with the labor furnished by land

owners and others residing along the roads in working out their road taxes, which is hardly sufficient to keep the roads in passable condition.

As to material at hand for roadmaking along our lines in Oregon and Washington, the natural soil makes very good dry-weather roads, except that roads become very dusty when there is heavy travel during the summer, but during the wet or winter season, especially west of the Cascade Mountains, these natural roads become almost impassable when there is much travel. The same is true of the roads in the eastern part of Washington and in the more elevated and mountainous parts of eastern Oregon. But the middle portions of Oregon and Washington have a lighter soil which is not so badly affected by moisture, and consequently have fairly good natural roads.

Along the Columbia River from Portland to Wallula, along the Snake and Umatilla Rivers, and along most streams of any size, there are high basaltic rock bluffs, under which there are slopes containing vast quantities of broken basaltic rock of excellent quality for macadam. Much of this broken rock is small enough for use, and the remainder can be readily broken up into sizes required for road-making. In many cases these rock slopes extend down to our track, and the rock could be loaded on cars by steam shovel for 10 or 15 cents per cubic yard.

Along our line down Burnt River, west of Huntington, there are mountains of limestone on either side of the track. This lime rock is in solid masses, and would have to be moved out of place by means of powder; but it is very hard, and would make excellent road material when broken up.

Along most streams of any size there is plenty of good gravel, and for miles around Spokane, Wash., the whole country is a gravel deposit of good quality.

Oregon and Washington have an abundance of good road material, convenient to our lines of railroad, that can be had at very little cost, except for transportation.

LETTERS FROM VARIOUS RAILROAD OFFICIALS.

Below are given extracts from letters received by the U. S. Department of Agriculture from officials of various railroads in States west of the Mississippi River, the information in some cases being furnished by the officer addressed and in other cases by the subordinate to whom the request was referred:

ST. LOUIS SOUTHWESTERN RAILWAY COMPANY.

[Furnished by S. W. Fordyce, president, St. Louis, Mo.]

In compliance with request contained in your circular dated October 16, issued in pursuance of authorization by Congress to make inquiry into the systems of road management throughout the United States, methods of road-making, etc., I have pleasure in submitting herewith reports from the different departments of this company in response to the various queries contained in the above-mentioned circular.

I desire to express my appreciation of the importance of this inquiry and my belief in its far-reaching beneficial effects. The West, particularly, is in need of a

stimulus in the direction of more systematic and painstaking methods of road-making, which the pressure of other material questions in a new country has unfortunately, in many instances, relegated to the background. It is trite to say that in an age when the construction of great highways (railroads) has been pushed forward to an unprecedented extent, the innumerable tributaries (wagon roads) have, for the most part, in this country been left to take care of themselves, with what loss it is needless to mention.

[Furnished by A. S. Dodge, general traffic manager of the St. Louis Southwestern Railway Company, St. Louis, Mo.]

We make very low rates on sand and stone. These rates would apply on road material. There is very little road building in our territory, and what roads have been built have been manufactured out of the local material. We have, in a few instances, made half rates on lumber to build bridges across streams in order to perfect wagon roads between points in the interior and stations on our line. I feel that I can indorse the object for which the Department of Agriculture is seeking this information. Good wagon roads are essential to the prosperity of the country. The better the wagon road, the better the condition of the residents, financially and morally. It might be said that the improvement of the wagon roads would take business away from the railroads. While this might be the case with farm products to a limited extent, the increase to the railroads of a higher class of tonnage, in building material, improved farm implements and machinery, and the increase in the use of domestic luxuries, will more than compensate the railroads for the loss of what the farmer can carry to market by improved wagon roads instead of shipping it over the railroad.

Furnished by H. G. Kelley, resident engineer of the St. Louis Southwestern Railway Company, Texarkana, Tex.]

My experience and knowledge of the country adjacent to this railway would indicate a scarcity of road-making material throughout most of the counties through which it runs. There are some localities, however, where material suitable for road making can be had, and I will review them by States, and in their order as reached by the railway, going south from Delta, there being nothing between Birds Point and Malden, where the Delta section intersects the main line.

(1) In Stoddard County, Mo., on the line of the Delta Branch, there are some large deposits of compact limestone, suitable for road material and within one-half mile of the railway, which can readily be reached by spur tracks. This limestone lies in large masses or hills projecting above the surface of the surrounding swamps, and will give about 50 feet of vertical quarry face when opened. It is of a hard, compact texture, but much shattered in its stratification, and varies from a light gray to a slate color. It breaks easily with a cubical fracture. It is excellent material for concrete stone, railway ballast, and road metal, and could probably be loaded on cars from a crusher at about 65 cents per cubic yard.

(2) Through Clay, Greene, and Craighead counties, Ark., the railway skirts the foot of Crowleys Ridge, and finally passes across it in Craighead County. These gravel deposits on Crowleys Ridge are found on the summits of the ridges and spurs; they have been by some termed a moraine from the Glacial epoch. The gravel is of excellent quality, lying in beds or banks of from 10 to 20 feet thick, the largest stones of which will pass through a 2-inch ring. They are of a silicious composition, and are not carbonates as are found in Texas. The matrix is principally coarse sand with occasional spots of clay and fine sand; much of it is also in cemented banks, requiring blasting for its removal.

The deposits are easily reached by wagon roads, but are difficult of access by railway; it could be loaded upon wagons or cars at from 15 to 20 cents per cubic yard. It will make excellent railway ballast and answer admirably for road making; when spread out and rolled, or subjected to wagon travel, it has a tendency to cement into a solid mass.

(3) In Calhoun, Ouachita, Columbia, and Miller counties, Ark., gravel deposits similar to the above are found, but in less frequent localities; these deposits are found on ridges and hills, the same as at Crowleys Ridge, possess the same characteristics and qualities, and appear to be of the same origin.

(4) In Texas we find some outcroppings of silicious gravel in Bowie County, but the larger part of this deposit lies in the northeastern part of the county. It appears to dip slightly to the north, and passes under the city of Texarkana at a depth of about 20 feet. The quality of this gravel is inferior to that found in Missouri and Arkansas, containing considerable red clay in the matrix. It is difficult of access by railways, but can be reached by wagons and obtained in limited quantities at the cost of ordinary loading and hauling.

(5) In Camp and Upshur counties deposits of a curious mixture of iron-stained sand, incipient sandstone, and red clay are found in two or three localities. The deposits are easy of access, both by railways and wagon roads, and should be loaded upon cars at a cost not to exceed 15 or 20 cents per cubic yard.

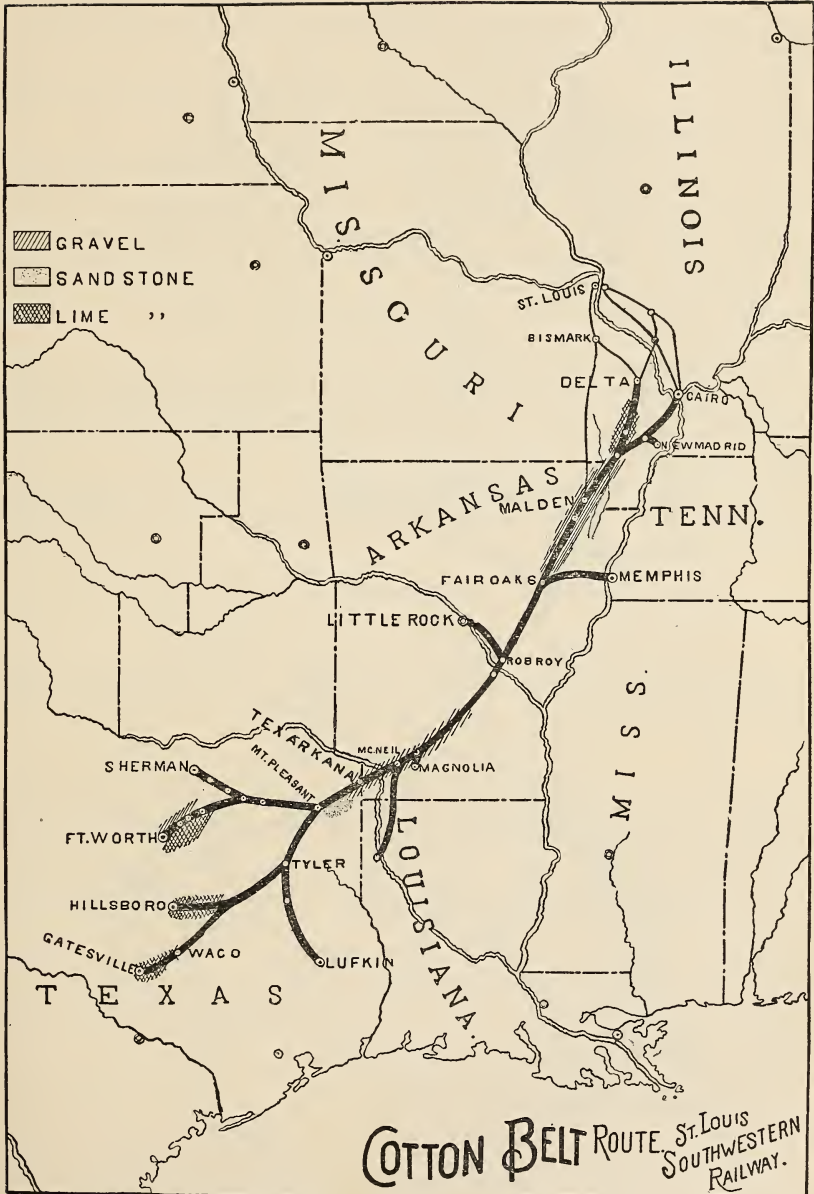
(6) In Hill, McLennan, Grayson, Dallas, and Tarrant counties deposits of limestone are found suitable for railway ballast and road material. The limestone is white, rather soft, and most of it weathers in from two to four years when broken or exposed to the open air. It compacts and crushes under wagon service into a hard mass, resembling a macadam pavement, but not so durable; but when applied in a layer of 6 to 8 inches thick, with large stones at the bottom, makes an excellent wagon road, which can be maintained with slight repairs for several years. It should be furnished by a crusher and loaded on cars at from 50 to 65 cents per cubic yard.

(7) In Coryell County large deposits of limestone similar to those found in the counties above are found, and several ledges of a much superior grade also exist on the line from Waco to Gatesville. These latter quarries make an excellent lime and a fair quality of cut stone, suitable for Ashlar masonry, can be had from one or two of the quarries. There are also in Coryell County several deposits of a limestone gravel, which can be used for nearly all purposes for which silicious gravel can be used.

(8) In Dallas County there is also found a deposit of iron-stained sandstone accompanied with red sand, which is excellent material for railway ballast and road making. It lies in horizontal beds, much shattered, and in a quarry face of 15 feet, would average about 3 feet of available sandstone. It is cheaply quarried and broken by hand, and is convenient to the railway tracks.

(9) In Tarrant County there are scattered deposits of gravel, which have not been extensively worked, but which have been used on the suburban roads of the city of Worth with excellent results.

(10) The improvements of the roads throughout the counties mentioned present no unusual conditions, with the exception of the black, waxy lands of Texas. With these there is but little experience to draw from, but from my own personal observation in the improvement of station grounds and roadway approaches I am inclined to believe that beneficial results can be had by using a coating of sand on the top of the black soil before the rock or gravel is used, the black, waxy soil having a tendency to work up through the broken stone unless first protected by the sand. The sand deposits lie in more scattered localities, but are usually convenient to railways; the principal deposits being in Upshur, Henderson, McLennan, and Dallas counties.



ATCHISON, TOPEKA AND SANTA FE RAILROAD COMPANY.

[Furnished by J. W. Rinehart, president, New York, N. Y.]

Iowa.—The small territory in Iowa crossed by our line abounds in hard limestone of the very best quality for macadam, and we have one spur track at the Des Moines River, running into a large quarry.

Missouri.—With the exception of 6 miles, near the Des Moines River, and 20 miles along the Missouri River bluffs, between Sibley and Sheffield, neither stone or gravel in any quantity has been found near our line.

Kansas.—In general it may be said that all of the line in Kansas, lying east of a line drawn north and south through Florence and Arkansas City, is well supplied with limestone suitable for road-making. No gravel of any consequence has yet been found. Much of the limestone is combined with magnesia, which would render it unsuitable for roads with heavy traffic, but it is sufficiently durable for all practicable purposes, when used on country roads. The entire western portion of Kansas is generally destitute of stone or gravel; but the natural surface and light rain-falls render artificial roads comparatively unnecessary.

West of Kansas.—In the Territories of Colorado, New Mexico, and Arizona, crossed by our line, the natural roads could be but little improved upon, and will probably remain as they are for ages to come. The principal work to be done in these Territories will be in the nature of expensive grading, where roads traverse rocky canyons, and to reduce grades in crossing the mountain ranges.

Oklahoma.—This Territory is generally destitute of suitable material for good roads. The soil is sandy, and, while the rainfall is heavy, the necessity for improving the country roads is not marked.

SAN ANTONIO AND ARANSAS PASS RAILWAY COMPANY.

[Furnished by T. E. Stillman, president, New York, N. Y.]

In reply to circular letter of October 16, requesting certain information for the Department of Agriculture, I beg to submit the following:

The supply of road materials.

(1) San Antonio to Kerrville: Inexhaustible quantities of rock, easily handled and within easy distance of any station of this division; much of it close to our track along the entire division.

The first 5 miles east of San Antonio: Concrete gravel in patches at a distance of from one-quarter to 2 miles from Riverside Spur, which is about 5 miles south of San Antonio.

Between Falls City (Brackenridge) and Kenedy: Rock suitable for macadam in large patches at distance from 1 to 2 miles of our line.

Gregory to Corpus Christi: Inexhaustible quantities of shell close to our line; very fine material for roads.

Rockport Branch: Nothing but sand and natural soil.

Alice Branch: Nothing but sand and natural soil.

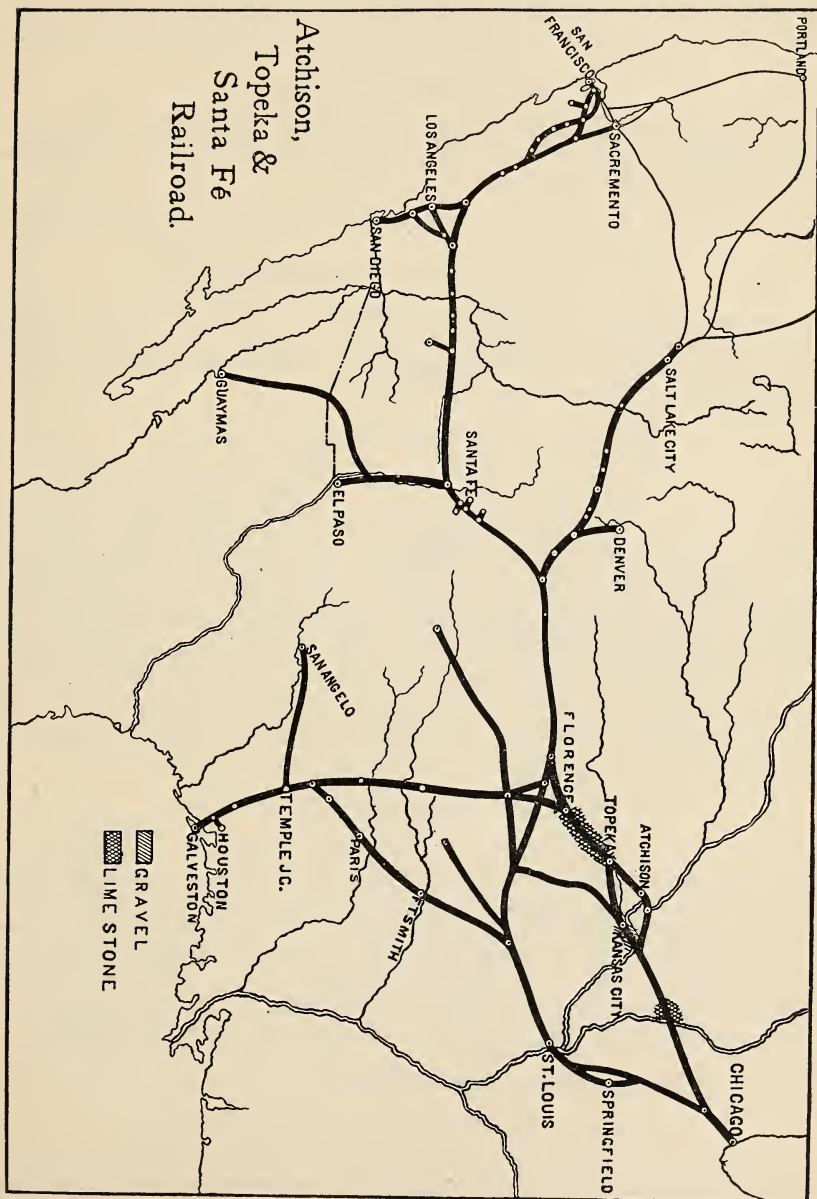
Kenedy to Yoakum: Nothing but natural soil excepting near Cuero, where there is close to the line a gravel pit, but quantity of gravel limited.

Yoakum to Houston: Nothing but natural soil excepting at and within 2 miles of Cheetham; gravel pit there is good; shallow gravel in patches, say, 50 acres.

Flatonia to West Point: Large quantities of rock within half a mile of the line at different points.

Colorado River to Winchester: Large quantities of fine gravel from 10 to 25 feet in depth at distance from one-quarter to three-quarters of a mile from the track.

One mile south of Serbin: Half a mile of shallow gravel close to the line.



Little River to Cameron: A limited quantity of good gravel from one-fourth to 1 mile of the track.

Gurley to Waco: Large quantities of gravel very conveniently located to the track; this, however, is about all overlaid with about 3 feet of natural soil.

Lockhart Branch, north and south of Luling for a distance of 1 mile, considerable quantities of gravel, as far as now known, from 2 to 5 feet deep close to the line.

In regard to transportation charges.

We have no regular schedule rate for transportation of material.

Can safely name 1 cent per ton per mile on material to encourage road building to points on and tributary to this road.

BURLINGTON AND NORTHWESTERN RAILWAY—BURLINGTON AND WESTERN RAILWAY.

[Furnished by T. W. Barhydt, president, Burlington, Iowa.]

Referring to inquires of October 16 I have to say that gravel for road purposes can be obtained at Coppock, and will cost 60 cents per yard on our cars at that station. Crushed stone can be had at same station in unlimited quantity, and will cost 70 cents per yard on our cars.

ROCK ISLAND AND PEORIA RAILWAY COMPANY.

[Furnished by H. B. Sudlow, superintendent, Rock Island, Ill.]

Yours of October 16, calling for information relative to materials for making good roads along or near our line, is at hand and noted. In reply I will say our line runs through a prairie country in which there is neither stone nor gravel, except in very small amounts, along our line, but we have plenty of bad roads in rainy weather. I would suggest that the solution of the public highway question through a prairie country lies largely in burnt-clay ballast. It is less expensive than broken stone, and when placed upon a properly drained roadbed it will make an excellent road, particularly free from dust, and will wear a great many years.

Referring to freight rates, the Illinois classification and schedule of rates as adopted by Illinois railway commissioners will govern on material referred to.

STUTTGART AND ARKANSAS RAILWAY COMPANY.

[Furnished by A. V. Stafford, receiver.]

The country through which this road runs is prairie and alluvial bottoms. There is no "road material" in the sense of gravel or stone or anything more substantial than the soil of the country for making dirt roads. Hence you will see we have no rate for transportation, nor is there any effort among our people to bring in from other points any material for macadam or pike roads.

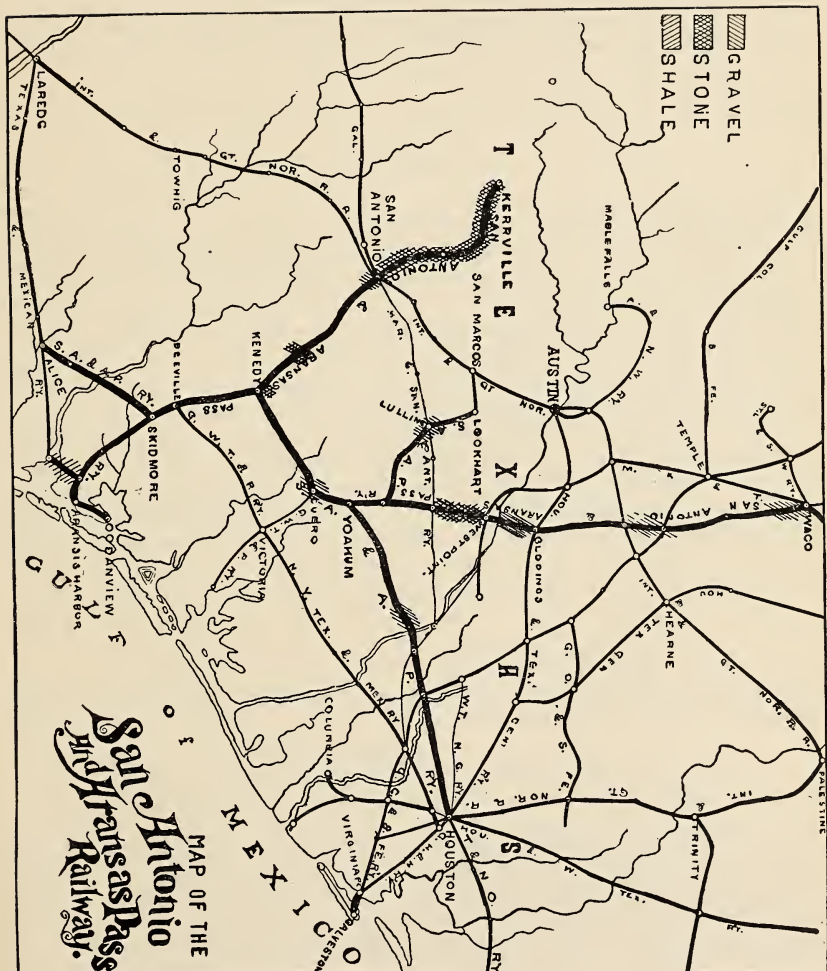
We favor the building of such roads, and would make very low rates for transportation of material if any such movement was inaugurated among our people.

ST. LOUIS, KEOKUK AND NORTHWESTERN RAILWAY COMPANY.

[Furnished by W. W. Baldwin, president, Burlington, Iowa.]

Replying to yours of the 2d ultimo would say, that it has always been our policy to make liberal concessions on any freight moving from point to point on these lines to improve the roads.

The regular tariff on such material would be class "E," which is the lowest basis of rates, but we have gone below this and used figures representing the actual cost of the service, believing that any improvement in the roads would, in the long run, help our towns and interests.



Limestone rock suitable for road-making can be found over the whole length of the St. Louis, Keokuk and Northwestern Railway, from Burlington to St. Peters, and is easily accessible.

Stone known as riprap stone can be purchased F. O. B. cars from 50 cents to 75 cents per cubic yard; broken stones suitable for macadamizing can be obtained from 75 cents to \$1 per cubic yard, although for a large contract the latter stone can be obtained for about 50 cents per cubic yard.

On the Chicago, Burlington and Kansas City Railway very good limestone rock can be obtained in the neighborhood of Farmington, Iowa.

Gravel is found in very liberal quantities but of poor quality on the St. Louis, Keokuk and Northwestern Railroad, the principal fault being a large per cent of sand is mixed with the gravel.

MISSISSIPPI RIVER AND BONNE TERRE RAILWAY, AND THE ST. JOE RAILWAY CO.

[Furnished by J. Burns, superintendent, Bonne Terre, Mo.]

Replying to your circular of the 16th of October ultimo, requesting information regarding the supply of good road materials along or near our lines, their location, character, accessibility, etc., I have to say that the materials for good roads lie in greatest abundance contiguous to all the public country roads near our line. There is no need of railway transportation, except for bridges, and both bridge timber and transportation are very inexpensive in this section of the State of Missouri.

There is great need of public attention to the construction of roads in this region. Considerable money is wasted by the old modes of fixing or repairing the roads. In many portions of the district through which our railway is built there are no roads that deserve the name. What are called roads are tracks, usually below the surface of the surrounding country, and therefore troughs or ditches in wet weather, with an abundance of loose rock and stumps, and scarcely passable at any time. No roads have been constructed in places, the earth and stones have been scraped or plowed to the center of the track for a number of years, and thus it is less destructive to beast, vehicle, and travel to pass over them.

The system of county roads once established and enforced, if moderately pursued, would soon give us good roads. These would greatly enhance the value of lands and improve every part of the country.

am unable to make any suggestion which would prove of immediate use. The obvious mode of reaching the end desired is by education of the public as to the effect and remunerative value of good roads.

KANSAS CITY, FORT SCOTT AND MEMPHIS RAILROAD COMPANY.

[Furnished by George H. Nettleton, president and general manager, Kansas City, Mo.]

We have hauled a considerable amount, in the aggregate, of what is known here as Joplin granite, but which is really limestone and chert crushed, for the purpose of getting other mineral (zinc and lead) from it. This makes a very good top dressing, and it costs, delivered on cars, about \$1.50 per cubic yard. We have been hauling it at a rate of from 3 to 5 cents per 100; 3 cents for 75 to 100 miles, and 5 cents for 175 miles.

BURLINGTON, CEDAR RAPIDS AND NORTHERN RAILWAY COMPANY.

[Furnished by C. J. Ives, president, Cedar Rapids, Iowa.]

Your circular letter of October 16 in regard to the best methods of road-making is received, and I inclose you remarks on material, etc., made by our chief engineer, Mr. H. F. White.

For my part of the communication would say that owing to the different formations through this country, the principal one being natural prairie dirt, would think

it would be all right for road-making through a large portion of the State. Of course some places should be treated with gravel and some with stone. But the prairie dirt, when placed in the proper position and well drained, makes an excellent road, however. The principal thing in my mind in preserving the road after it is made is wide tires on all wagons carrying heavy loads. It matters not how good the road is built or of how good material if it is to be cut up with ordinary farm wagons with narrow tires and a heavy load. The excellent roads of Great Britain and the continent are often spoken of as the acme of perfection, and my observation in these countries fully justifies the remark, but care in the maintenance of these roads aside from good material and cheap labor is the character of the vehicles which carry heavy loads. On this account, more specially, the four-wheeled vehicles have a narrower tread for the front wheels than the rear wheels, and all are equipped with wide tires. This prevents forming ruts in the roadway, smooths down and hardens the surface. Therefore, in my mind, road-making in this State, and such other States as are similarly situated in regard to material, would have to be supplemented by wide-tired wagons, and legislation in that direction would of course be necessary in order to enforce it; and I would suggest that a law be passed prohibiting the sale of any new wagons except as are provided with proper width of tire, and that wagons now in use should be immediately rebuilt in this direction and a compensation made to the owner by the reduction of the necessary expenses from his road tax. It is hardly necessary to add that the road tax should be paid in cash, and the "working of the road," as it is usually styled, should be entirely done away with, as they are usually left in worse condition than when commenced on. If a general system of road-building was to be adopted I would suggest that part of the road tax should represent the interest on a long-time, low rate of interest bond, issued by each county, and the money derived from the sale of these bonds could then be applied directly to the building of such principal roads as the officers of the county might determine. These bonds need not necessarily ever be paid, but be refunded from time to time on the same plan as railway bonds. This scheme would not entail on taxpayers any additional burdens from those of the present ones and would provide at once a section of good roads throughout the whole country.

[Furnished by H. F. White, chief engineer, Cedar Rapids, Iowa.]

Material for road-making, which can be found along or near the lines of Burlington, Cedar Rapids and Northern Railway, comprises the following: (1) Stone; (2) gravel; (3) clay, which can be burned into ballast.

Stone.—Generally a hard limestone is found in the bluffs, along the larger streams, not very plenty, neither of a quality that makes good macadam, being generally too soft for that purpose. At a quarry where the chips can be used this class of material can be bought on cars, crushed or broken by a rock crusher, for about 50 cents per cubic yard. Where rock is quarried especially for crushing, price is about \$1; deposits of this rock are too scattered to afford material for much road building.

In southeastern South Dakota, in vicinity of Sioux Falls, and in southwestern Minnesota, there are large areas of a very hard rock—quartzite—which makes the best of macadam; cost, crushed, free on board cars, \$1.25 per cubic yard.

Gravel.—There are numerous deposits of good gravel over the northern one-third of Iowa, west of the Cedar River, which costs, loaded on cars in our gravel pits, about 8 cents per cubic yard.

Burnt clay.—This material can be made from any clay or muck that is entirely free from grit at a cost of about 60 cents per cubic yard on cars. It is, however, a very poor material for roads as, while it absorbs water and prevents roadbed underneath it from becoming muddy, it is very easily cut into ruts, becomes very dusty and blows away.

RIO GRANDE WESTERN RAILWAY COMPANY.

[Furnished by William J. Palmer, president, Colorado Springs, Colo.]

I beg to acknowledge, although at a late day, your letter of October 6, 1893, and to inclose herewith copy of a letter of November 27 from our engineering department and of the inclosure to which he refers. This company would make for the commendable purpose to which your letter calls attention a rate of 1 cent per ton per mile with a minimum total rate of 50 cents per ton.

[Furnished by E. J. Yard, resident engineer, Salt Lake City, Utah.]

Replying to attached letter relative to supply of good material along the line of the Rio Grande Western Railway, I have to say that Mr. A. F. Doremus, city engineer Salt Lake City, has been kind enough to reply by attached letter from him of November 22, and also given verbally his experience with various classes of materials which it has been proposed to use recently in paving various streets in this city. His experiments have proven that none of the shales, sandstones, or lime rocks available near here would make good road material, but that the best would be the refuse slag from the various smelters south of the city, or broken quartzite, of which latter there is, perhaps, the largest deposits on the Tintic branch, the large cut about one mile west of Eureka being perhaps the best.

The waste material from the Eureka mines is largely this material, and would probably be loaded on cars by the mine owners, free of cost, as dumping room for their waste material will soon be a serious question in that district. Our experience is that this material makes excellent ballast for track.

[Furnished by A. F. Doremus, city engineer, Salt Lake, Utah.]

It is the general opinion, based on experience so far, that the macadam method for ordinary roads is the most desirable and that the best stone for this purpose is that which is hard and chrySTALLINE rather than granular in nature; or, in other words, that which is the most difficult to reduce to powder (dust and mud) is the best adapted for road purposes. This class of stone abounds in unlimited quantities in Parley's Canyon, and also in Tintic. There are, I think, also some ledges in Bingham and a large deposit near the warm springs just north of this city.

Furnace slag is also valuable for this purpose, being extensively used in Pennsylvania and in some parts of Europe. It is customary to use the slag in the lower stratum of the work, and to cover it with a suitable stone. You, of course, have great quantities of slag at various points along your road as well as suitable stone; in fact, such deposits as will enable you to supply any quantity and of the very best quality.

